B Scene



Vol 1, No. 6 • Bioscience Division Newsletter • March 27, 2000



Sandra Zink, right, of the Bioscience Division presents distinguished virologist Bernard Roizman of the University of Chicago with a certificate in commemoration of his giving the inaugural talk for B Division's Distinguished Speaker Series. Photo by Leroy N. Sanchez

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Women's Diversity Working Group poster contest





Double Issue No B Scene Spring Break Week April 3rd

B Division Begins New Distinguished Speaker Series Bernard Roizman, Professor of Virology, University of Chicago, inaugurated B Division's new Distinguished Speaker

Bernard Roizman, Professor of Virology, University of Chicago, inaugurated B Division's new Distinguished Speaker Series March 15th with a talk entitled: "Herpes Virus vs the Cell: The Strategy of Conquest." Roizman explained how a virus with less than 100 genes overcomes a cell of many hundreds of thousands of genes. The primary strategy of the virus is to block the cell's response to the invader by preventing the production of specific proteins. These proteins would set up a series of events leading to apotosis or "cell suicide." The virus prevents the process of cell death until the virus has achieved its replication function, at which time the cell is no longer needed and it is overwhelmed. Roizman was the guest of Gerry Myers, head of the Bioinformatics team in B Division. Roizman provides expert advice for the team's database development.

Roizman is a distinguished virologist and holds the Marjorie B. Kovler Professor of Virology chair at the University of Chicago. From 1984 to the present he has also been the Joseph Regenstein Distinguished Service Professor of Virology in the Departments of Molecular Genetics & Cell Biology and in Biochemistry & Molecular Biology. He is the recipient of many awards and honors: Pasteur Award, Bristol-Myers Squibb Award for Distinguished Achievement in Infectious Disease Research, 1998; and elected member of the National Academy of Sciences, 1979. In addition he holds many honors from Europe, including the ICN International Prize in Virology, the Sesquicentennial Gold Medal from the University of Ferrara in Italy and the J. Allyn Taylor International Prize in Medicine. He is also the recipient of NIH's prestigious Outstanding Investigator Award 1988-2001.

Contributed by Sandra Zink

B Division Hosts Navajo Nation

Bioscience Division hosted a LANL-Navajo R&D Meeting on March 15th to exchange information on various topics, including water quality, remediation of uranium mine tailings and telemedicine. Fred Begay, CRO; and Don Peterson and Sandra Zink, B Division, served as meeting co-chairs. Begay, himself a Navajo, is interested in fostering greater collaborations between the Navajo nation and the Laboratory on problems of mutual scientific interest and importance. Attending from the Navajo nation were Taylor McKenzie, Vice-President, and his Division Directors: Arlene Ruther, EPA (representing Derrith Watchman-Moore); Tony Skrelunes, Economic Development; Marlene Jasperse, Health; Bennie Williams, Water; and Teresa Hopkins, General Services. In addition, representatives from the US Geological Survey (USGS) and the Army Corps of Engineers (USACE) attended.



Scott Cram (right), Deputy Director, B Division, provided an overview of the Laboratory and Bioscience Division for the Navajo visitors. Taylor McKenzie, Vice-President for the Navajo nation, is on the left

McKenzie opened the morning program with a list of strategic objectives for his administration: 1) walk in beauty into the new millennium; 2) improve human resources by identifying people who are trained and skilled to work in the new administration; 3) develop a secure financial foundation; 4) preserve the Navajo culture, language and identity; 5) maintain, preserve and protect Navajo sovereignty; and 6) bring industry and science to the Reservation without dimensioning its sovereignty. Following presentations in the morning by several Los Alamos scientists, a round-table discussion was held to address how to establish a closer working relationship among the participants. Begay has agreed to provide staff support to establish a joint USGS-USACE-LANL-Navajo Working Study Group that will be tasked with addressing R&D issues that emerged from the meeting. For example, a critical issue will be to direct expert attention to characterizing the water aquifer-uranium ore system, which is located in the Church Rock-Crownpoint, NM region of the Navajo Reservation. It was proposed that technical staff from the joint Working Group hold a planning meeting at the Navajo Nation Headquarters, Window Rock, AZ, in the near future to determine the scope of the research program and to develop funding strategies to support research and education initiatives.



"Our task is to demonstrate that the Navajo concept of radiation can be used to discuss, in the Navajo language, modern issues such as nuclear radiation and radioactivity, which is vital for the Navajo public understanding of the impact of nuclear science and technology on the quality of their life."

Fred Begay, Community Relations Office, LANL, is the only Navajo to have earned a Ph.D. in physics. He has merged his knowledge of physics with his Navajo culture to create a paper describing the Navajo view of radiation and explains that the concept of science such as radiation is used extensively in Navajo religion and medicine. Begay is President of the Seaborg Hall of Science, a non-profit organization whose mission is to provide public services to the Navajo community in science and technology matters.

A traditional Native American lunch was served by the Hummingbird Flower Catering Service of San Ildefonso Pueblo. The red chili stew was served with buffalo and beef. Green chili stew, posole, beans and bread completed the menu with traditional Indian bread pudding as dessert. Prune pies were served as morning snacks.

Contributed by Sandra Zink



Lucille Calabaza-King, San Ildefonso Pueblo, (right) is the proprietor of the Hummingbird Flower Catering Service. Her mother, Blue Corn, is an internationally acclaimed artist known for her traditional pottery. Hummingbird Flower's menu represents the Native American traditions and features foods that have existed for hundreds of years in the Southwest. Margaret Atkins (left) assisted with the lunch. Both Lucille and Margaret are assigned to the B Division office and provide staff support in the HRL.

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DARPA Visitor

Frank Fernandez, Director, Defense Advanced Research Projects Agency (DARPA), spent a day March 23^{rd} , touring Laboratory facilities and learning about Los Alamos capabilities and technologies. Don Cobb, Associate Laboratory Director for Threat Reduction, hosted Fernandez' visit. Jill Trewhella, Bioscience Division Director, set the stage for a round-table presentation of bioscience capabilities that span the microscopic world (DNA signatures) to the macro world of infectious disease modeling and surveillance.

Cheryl Kuske, described work that Los Alamos has pioneered to identify microorganisms with high specificity. A phylogenetic tree summarizes graphically how microorganisms are closely related to each other and how those that are known to cause serious infection are closely grouped. Goutam Gupta, showed a method that he has developed for defeating a well-known pathogen, staphylococcal enterotoxin, which can lead to shock and even death in the human host. His technique is the synthesis of a molecule that imitates the host cell receptor, which then acts as a decoy for the pathogen, binding to it and rendering it harmless. Developments of novel biosensors that imitate nature were reviewed by



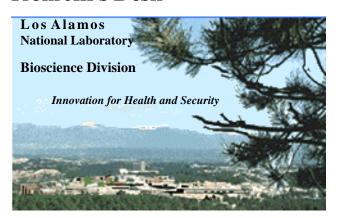
Left to right: Basil Swanson, Goutam Gupta, Sandra Zink, Jill Trewhella, Catherine Macken, Cheryl Kuske, Jose Olivares

Basil Swanson. Using multiple receptors in a platform that simulates a cell membrane, the sensors are capable of orders of magnitude greater sensitivity than the best conventional techniques. Furthermore, the sensors do not require reagents and produce results within minutes compared to hours. Jose Olivares described instrumentation technologies that integrate the basic biological and sensor work into fieldable instruments. He also described a new project that uses spectroscopic analysis tools to characterize microorganisms rapidly. A modeling and simulation effort focused on infectious disease was described by Catherine Macken, T Division. The model combines the mobility features of TRANSIMS, a LANL-developed traffic simulation tool based on synthetic populations, with the infectious characteristics of a virus being spread from person to person. This effort also involves collaborators with the state Office of Epidemiology, New Mexico Department of Health. A state-wide consortium for medical surveillance was described by Sandra Zink. The consortium combines the resources of Los Alamos. Sandia, the state Department of Health, the UNM Medical School and Lovelace Respiratory Research Institute. A pilot project will collect syndrome-based

data of patients presenting with flu-like illness in Emergency Rooms and Urgent Care Centers in the state and return geographical plots of similar cases to the ER physicians. The effort seeks to establish the background of flu-like illness in New Mexico and to also collect data for the validation of the modeling and simulation effort.

Contributed by Sandra Zink

From Jill's Desk



This week will be hectic...

Dr. Gabrielle Kraatz-Wadsack, United Nations Special Commission, is our guest for the Director's Colloquium next Tuesday at 1:10 p.m. in the Physics Auditorium. She will talk about the "UN Role in Disarmament and Long-term Monitoring of Biological Warfare Activities in Iraq." I encourage you to attend; but please be aware that it is closed to the public and open to Lab employees only. It will not be broadcast on LABNET. Dr. Kraatz-Wadsack will be meeting with some of our B Division scientists in the morning prior to giving the colloquium.

As I described in the last issue of the B Scene, B Division is being highlighted in the upcoming UC Science and Technology Panel meeting this coming Thursday and Friday. At that meeting we will be highlighting our vision for the Division and your Scientific Thrust leaders are working hard to provide me with their strategic plans that have been evolving over the last several weeks. The support of the Panel for our vision will be important for us all.

We are also preparing for our first Division Review Committee meeting (see our first B Scene for the membership!). David Galas will be acting Chairperson for our first meeting scheduled for May 24-25. Our Communications Office is collecting materials now for the Annual Progress Report that will be provided to our review panel. If you have not sent in your reports to Sandra Zink (zink@lanl.gov), please do so. We need to present our new Division with our best science. Thank you for your help!

Jill

Communications Team Report

Our Communications Team is pleased to announce that the new B Division website is now public and can be accessed from the LANL Home Page. Thanks to Annette Archuleta for a great job! Although many parts of the website are still incomplete, we wanted to give you an opportunity to get a look at your new Division! Please continue to provide us with your feedback and suggestions as to how to improve it. Send your comments to Annette (ava@lanl.gov) or myself (zink@lanl.gov).

We are in the process of gathering progress reports from PI's regarding their projects in anticipation of pulling together an Annual Report needed for our Division Review Committee. We have about half the reports that we expected, so we are falling behind our deadlines. Please send your progress reports to me as soon as possible. Our Division is depending on you to give us the basic material for highlighting our great science. Thanks much!

Contributed by Sandra Zink

Biography



Tony Beugelsdijk, Ph.D., MBA, is the new LANL Research Park Project Leader, and dropped by Bioscience Division recently to share his experiences as an Industrial Fellow with Parke-Davis Pharmaceutical Research last year. Tony's new LANL assignment involves finding companies interested in leasing space in the Research Park as well as finding Los Alamos scientists willing to re-locate to the Park for the opportunity to work more closely with potential industrial partners. The Research Park will include a total of 5 buildings for a total of 300,000 square feet of R&D laboratory and office space. LANL has requested

DOE approval to enter into a lease for 25,000 square feet in the first building currently under construction.

Programs in the NW, TR, and SSR Directorates are currently being identified to occupy the LANL portion of the space. About 3,000 square feet are left. He would like to use that space to attract pharmaceutical companies to the Research Park, with ties to B Division, as well as CST, T, MST and CIC Divisions. Lease charges in the facility will be comparable to Division space charges. Potential areas of collaboration for B Division might involve development of new medical applications or understanding antibiotic resistance, high throughput genotyping, bioinformatics, assay development, proteomics and directed evolution, and sensitive detection technologies.

Reporting to the Senior Vice President of Pharmaceutical Development at Parke-Davis, based at Ann Arbor, MI, Beugelsdijk was treated to a first-hand look at the drug discovery process in a major pharmaceutical company. He learned about how compounds are targeted, how the primary and secondary screening takes place, followed by pharmacokinetic and animal studies. He was impressed with how the industry has changed over the last decade. Instead of the chemists and biologists spending most of their time at the Laboratory bench, they spend most of their time at a computer screen analyzing results that have been generated through the aid of automation equipment. Beugelsdijk came to the attention of Parke-Davis through his work at LANL in laboratory automation and as one of four co-founders (1997) of the Association for Laboratory Automation. He is a primary organizer for the annual LabAutomation and EuroLabAutomation, and smallTalk conferences.

During his year at Parke-Davis, Tony assisted in putting together an automation engineering team based on a blueprint of the LANL team, focusing on its value to the company and its place within the organization. He also participated in a technology strategy planning process. The outcome of that exercise was that Parke-Davis has created a technology management office, which will have a director and 4-5 staff, who will serve as technology scouts for the company and make recommendations for investments. "It was an exciting year," said Tony. "The science is captivating. It's a fascinating, high-stakes industry where the rewards are absolutely phenomenal." He added that Parke-Davis, a Division of Warner Lambert, is scheduled to merge with Pfizer, Inc., which will then have a combined \$4.7 billion research and development budget.

Beugelsdijk came to Los Alamos in 1984 from Shell Development Company, Houston. In Los Alamos, he led a team of 25 scientists and engineers to build the laboratory's robotics and automation program. He has managed the development of more than twenty robotics systems including the only four systems in the nation qualified to handle plutonium samples. Tony has also led the development of robotic systems to support the Human Genome Program and is active in extending the use of robotics and automation technologies in clinical practice. He has been a champion of robotics technologies in molecular biology, biotechnology, and

drug discovery. In 1989, he originated the Standard Laboratory Module or SLM concept and formalism on which the Department of Energy's multi-laboratory Contaminant Analysis Automation program and an ASTM standard is based. This program grew to include six national laboratories, three federal agencies, and two industrial partners and is developing modular technologies for automation of the laboratory of the future. In addition to 4 issued patents, he has published more than 50 papers, been recognized with 2 industry awards, and edited a book on technologies for genome characterization.

Contributed by Sandra Zink

Bucks

NIH Corner

In order to write a grant application that will be funded, it is good to consider beforehand the evaluation process which will be used by NIH to determine funding. There is a pretty good description of this process now on the website of the NIH Center for Scientific Review (CSR), specifically http://www.drg.nih.gov/REVIEW/policy.htm. CSR is a completely separate entity at NIH, not associated with any Institute or Center, and entirely devoted to the grant review process. The path that your application follows after submission is well described on the website and I will not repeat it here. What I would like to emphasize is that you can also find the guidelines for review of each of the 11 types of NIH applications CSR reviews (http://www.drg.nih.gov/guidelines/proc.htm#specifi c). Most of these are slight modifications of the basic guidelines for reviewing an R01 (i.e. "investigator initiated") application. These are exactly the same guidelines that Study Section members receive in their little instruction packets before the meeting. The "meat" of these guidelines are in the five specific review criteria that CSR has mandated for R01 applications, which are reproduced below exactly as NIH has defined them:

- 1. Significance Does this study address an important problem? If the aims of the application are achieved, how will scientific knowledge be advanced? What will be the effect of these studies on the concepts or methods that drive this field?
- 2. <u>Approach</u> Are the conceptual framework, design (including composition of study population), methods, and analyses adequately developed, well integrated, and appropriate to the aims of the project? Does the applicant acknowledge potential problem areas and consider alternative tactics?
- 3. Innovation Does the project employ novel concepts, approaches or methods? Are the aims original and innovative? Does the project challenge existing paradigms or develop new methodologies or technologies?
- 4. <u>Investigator</u> Is the investigator appropriately trained and well suited to carry out this work? Is the work proposed appropriate to the experience

- level of the principal investigator and other researchers (if any)? PLEASE DO NOT INCLUDE descriptive biographical information unless important to the evaluation of merit.
- 5. Environment Does the scientific environment in which the work will be done contribute to the probability of success? Do the proposed experiments take advantage of unique features of the scientific environment or employ useful collaborative arrangements? Is there evidence of institutional support? PLEASE DO NOT INCLUDE description of available facilities or equipment unless important to the evaluation of merit.

As you might guess, a large NO in response to several of the questions above will not bode well for your application. In addition, reviewers are advised to consider a couple of other things if they are appropriate. If the application is a Competitive Renewal of an



"I know, but all promises are off when Daddy's writing his grant proposals."

existing grant, reviewers are instructed to consider Progress made in the previous funding period. If you are submitting a Revised Application of a previously unfunded version, then the reviewers are instructed to consider the Response of the applicant to the specifics of the previous review. Reviewers are also instructed to evaluate whether the application properly deals with the use of Vertebrate Animals, Human Subjects, Biosafety and the appropriateness of the Budget. Reviewers are not given any specific weighting for these different evaluation factors, although I can tell you that the first three of the big five get much more attention and discussion than any of the other ones.

Finally, CSR makes one further modification of the review criteria. The NIH has decided that new investigators "are typically less experienced in the preparation of applications and expression of their research plans." Based on my experience, I am not sure

that I agree with this assessment (e.g. there are many "old investigators" who couldn't write a grant application to save their lives) and I do not think that you should write your application any differently just because you are a new investigator. However, since there are no longer special grant mechanisms for new investigators (like the now defunct FIRST awards), CSR identifies for the reviewers all applications from new investigators and instructs them to modify their review criteria. I have been unable to find a clear definition of a "new investigator," but it appears to me to be someone who is submitting their first grant application. Specifically, the instructions to reviewers for New Investigators are as follows.

"When reviewing these applications, reviewers should keep in mind the experience of and the resources available to the new investigator. When considering an application from a new investigator the five new review criteria must be evaluated in a manner appropriate to the expectations for and problems likely to be faced by a new investigator. Specifically, when considering:

- Approach: more emphasis should be placed on demonstrating that the techniques/approaches are feasible than on preliminary results;
- Investigator: more emphasis should be placed on their training and their research potential than on their track record and number of publications emphasis should be placed on their independent status; and
- 3. **Environment:** there should be some evidence of institutional commitment in terms of space and time to perform the research."

So, those are the official CSR guidelines for reviewing NIH grant applications. You should not be reluctant to specifically address each of the five main evaluation criteria in the writing of your application (e.g. don't leave it up to the reviewer to figure out why your idea is innovative or what is really the significance of the proposed work or whether you have the stuff needed to do the work). A clear, logical and concise (remember that from the last column?) statement of the Significance, Innovation and Approach go a long way toward helping the reviewers to apply the review criteria in a manner which you will appreciate. My experience with how the idealized CSR review process is actually applied before and during a Study Section meeting will be the topic of the next column.

Contributed by Jim Freyer

B There

Dr. Gabriele Kraatz-Wadsack Ministry of Defense, Germany United Nations Special Commission "UN Role in Disarmament and Long-term Monitoring of Biological Warfare Activities in Iraq". Physics Auditorium Tuesday, March 28, 2000, 1:10 p.m.

This colloquium is open to Lab Employees only. Abstract:

UN Role in BW Disarmament and Long-term Monitoring of Biological Activities in Iraq



Dr. Gabriele Kraatz-Wadsack

Following the Gulf War in 1991 and Irag's withdrawal from Kuwait, the United Nations was, for the first time, given authority to actually eliminate weapons of mass destruction from a UN member state. The UN Special Commission, of which Kraatz-Wadsack is a member, was set up to implement the arms control provisions of the resolution establishing the conditions of the ceasefire following Iraq's expulsion from Kuwait. Another resolution set forth a plan for ongoing monitoring and verification. The cornerstone of the inspection effort has been the right to conduct rigorous, no-notice, on-site inspections anywhere in Iraq. Despite the unprecedented rights of UNSCOM, achievements in the disarmament areas were limited, particularly in the biological weapons (BW) area, caused mainly by the failure of Iraq to disclose its biological warfare program in 1991. Only because the Commission had by 1995 gathered indisputable evidence that Iraq had had a significant BW programme, did Iraq disclose the weaponization of BW agents. However, the assessment of some 16 nations has led to the unanimous conclusion that Iraq had not disclosed the full scale and scope of its BW programme, nor could it be determined if the programme ended.

The B Division staff seminar series is on Mondays at 11 AM in the HRL auditorium.

TSM Seminar Schedule for April:
April 3, Charlie Strauss, B-S1, "Rapid Transition from Physics to Bioscience"

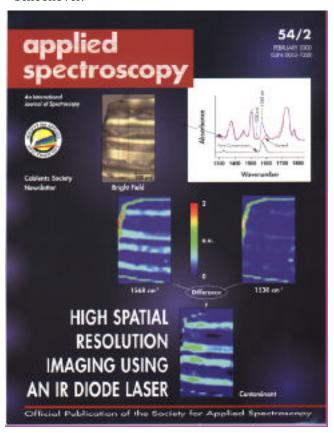
April 10, Robert Atcher, B-S1, "Nuclear Tracer Techniques for Detecting Residual Resource Management"

<u>April 17</u>, Jim Brainard, B-N1, Environmental Effects of Resource Management"

Bravo

Research Makes Cover Story

Work by B Division scientists made the February cover of Applied Spectroscopy. Authors of the paper are: Jim Bailey, Brian Dyer, Darla K. Graff, and Jon R. Schoonover.



On the cover A tunable IR diode laser is used to map contaminant distribution of a layered polymer sample (bright field shown upper left). The micro-IR spectra (upper right) revealed the presence of a plasticizer contaminant. The sample is probed at 1568 cm-1 (contaminant absorbance band) and 1530 cm-1 (background), and scanned with a step resolution of 10x10 ?m, generating two absorbance maps (middle panels). The difference between these two maps gives the corrected contaminant absorbance distribution shown in the bottom panel. All images are 300x500 ?m.

Conventional IR imaging techniques use a standard Fourier transform IR (FTIR) bench as the IR source. While this method produces single spectra rather rapidly, the glow-bar used in these systems has low spectral brightness. To obtain high spatial resolution in microscopy or imaging applications, an aperture is needed causing this already dim source to be attenuated further, necessitating long acquisition times for signal averaging. The tunable infrared diode laser produces a

high intensity beam at a single wavelength (0.25cm-1 or narrower) that can be readily focused to a spot size on the order of 50 micrometers. A diode can be tuned over approximately 100 cm-1 with single modes every 3-4 cm-1 and diodes are commercially available to cover most of the mid-infrared spectrum. The high intensity and small spot size allows delivery of more light to the sample than the conventional glowbar, even at small apertures, resulting in significantly improved signal-tonoise ratio. In addition, FTIR-based methods must collect an entire spectrum and therefore requires significant time to complete the scan. The single wavelength method is capable of producing high spatial resolution chemical images much faster, given that an appropriate wavelength is available. We have demonstrated the usefulness of this technique on a layered material that had been contaminated with a volatile substance. Similar application to microfabrication of silicon-based devices or multicomponent polymer-based materials with micrometer-scale has obvious benefits. Structural characteristics and aberrations of these materials may be non-destructively assessed by microscopic chemical analysis. Similarly, there is currently great interest in methods of intracellular and in vivo imaging. The chemical specificity of IR spectroscopy and its noninvasive character represent a powerful supplement to these investigations; however, the dimensions of cellular components such as nuclei are at or below the diffraction limit of IR light (2-5 micrometers). The ability to generate high spatial resolution IR images is therefore desirable. Further, by coupling the IR laser diode system to array detection, chemical images may be obtained in 'real time'. We plan to implement this detection technique in the near future.

Contributed by Jim Bailey



In January we ran a Bravo story on Kirk Rector, a postdoc working with Brian Dyer in BS-2, who had just been awarded the Frederick Reines postdoctoral fellowship in experimental sciences. Here is his picture. Kirk is also organizes a B Division post-doc seminar series.

Congratulations Kirk!

Breaking News

B Division Researchers were featured in two stories released by Public Affairs last week. They are copied here below from the **Newsbulletin**. In addition, the most recent issue of **Reflections** (March, vol 5, no 2) featured articles by Kay Roybal, on Jon Longmire's work called, "Birds of a Feather Do More Than Flock Together" and another by Ternel Martinez, called "Exploring the Biological Frontier which tells about the Human Genome Project. PDF versions of **Reflections** can be found by going to the web page: http://www.lanl.gov/worldview/news/reflections/ Please take a look.

Los Alamos Scientists Make Seven Bit Quantum Leap

Scientists at Los Ālamos National Laboratory have made yet another experimental leap forward in the quest for a functional quantum computer capable of solving large mathematical problems or cracking secret codes faster than today's fastest supercomputers.

Using nuclear magnetic resonance techniques, researchers created a seven-qubit quantum computer within a single drop of liquid. This latest advance could lead to computers that use quantum bits, or qubits, for information processing. The laws of quantum physics allow quantum particles to exist in multiple states; quantum particles can represent both a zero and one at the same time. This concept allows bits, in this case qubits, to be encoded at speeds beyond what is possible in a classical digital computer.

The advance and a proposal for benchmark experiments on which to base future quantum computer performance are described a paper in the March 23 issue of Nature magazine by Emanuel Knill, Raymond Laflamme and Rudy Martinez (B-S1) at Los Alamos and Ching-Hua Tseng of MIT.

If functional quantum computers can be built, they will be valuable in factoring large numbers and therefore extremely useful for decoding and encoding of secret and confidential information. Their arrival could spell trouble for Internet users. "You realize, of course, that if we had a operational quantum computer today, nothing on the Internet would be safe," Laflamme said. "Our current methods of encrypting secret or personal data, like the RSA public key encryption algorithm currently used in web browsers, would be nearly worthless."

Even with this latest advance, the world is still years away from a functional quantum computer.

Nonetheless, this recent development is a strong indication that quantum computing is quickly moving from the realm of science fiction into reality.

"What we find particularly intriguing, said Laflamme, "is that this latest advance seems to follow Moore's Law." Moore's Law says that the density of transistors on integrated circuits, and in turn the calculating speed of the computer, doubles every 18 months. The birth of the three-qubit quantum computer came roughly 18 months ago at Los Alamos. "I think it is a bit premature, however, to really assume it follows Moore's Law, but who knows what future technological developments will do. Of course, if Moore's Law is at work here," Laflamme added, "then we could have a 30-qubit quantum computer in less than five years."

A 30-qubit quantum computer would be roughly equivalent to a conventional computer running at 10 teraops, or trillions of operations per second. The fastest supercomputers in the world have achieved speeds of about two teraops. The quantum computer uses nuclear magnetic resonance to manipulate particles in the atomic nuclei of molecules of trans-crotonic acid, a simple fluid consisting of molecules made up of six hydrogen and four carbon atoms. The particles are like tiny bar magnets spinning in a magnetic field that can be "lined up" by applying an electromagnetic pulse from the nuclear magnetic resonance device. This lining up of spinning particles in positions either parallel or counter to the magnetic field allows the quantum computer to mimic the information encoding of bits -- zeros and ones -- in classic digital computers.

Quantum computer scientists believe they may someday be able to use nuclear magnetic resonance pulses of just the right frequency to manipulate or flip the quantum states of particles with sufficient reliability to create a functional quantum computer.

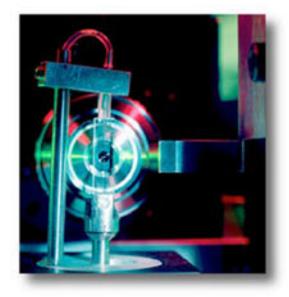
Los Alamos has been a leader in experimental quantum computation since quantum computers were first proposed in the early 1990s as a way to factor large numbers. The first three-qubit quantum computer was achieved at Los Alamos in 1998 using nuclear magnetic resonance and a trichloroethylene molecule.

➤ Todd Hanson, Public Affairs; sent in by Pete Silks

Researchers Develop Method for Rapid Fingerprinting of Bacterial DNA

A microscope lens focuses fluorescent light on a DNA sample in a Laboratory-developed ultrasensitive flow cytometer. The desktop-sized instrument is 100 times faster than conventional gel electrophoresis at analyzing DNA samples. Researchers at the Laboratory have developed a desktop-sized instrument that identifies the DNA fingerprints of bacteria, including biological threat agents. The new ultrasensitive flow cytometer is 100 times faster and 200,000 times more sensitive than conventional gel electrophoresis at analyzing DNA samples. And the process requires only minute quantities of DNA to obtain a reliable result. The new flow cytometer has applications beyond defense and counter-bioterrorism, according to its developers. In the food industry, for example, it can be used to detect the presence of salmonella and other bacteria. Public health and medical diagnostic workers will be able to use the flow cytometer to analyze outbreaks of E.coli, staph and other infectious diseases. The instrument also will aid in studies of the human genome. "If there should be an outbreak of a bacterial disease, we need to

know immediately what the pathogen is to be able to rapidly initiate treatment," said James Jett of the Bioscience (B) Division. "We wouldn't have days to figure out what we're up against. This flow cytometer may help us to determine the proper treatment much faster than we normally would."



Project leader Jett, Babs Marrone, Dick Keller and Tom Yoshida, all of B Division, developed the new cytometer. First developed at the Lab more than 30 years ago, flow cytometers use lasers to analyze, characterize and sort thousands of biological cells, chromosomes or molecules in minutes. Applications include analysis of white blood cells, DNA and RNA as well as biological functions. Researchers currently use pulsed-field gel electrophoresis to separate large DNA fragments according to their size. Although sizes can be determined with 90 percent accuracy, this method requires relatively large amounts of DNA -- roughly one-millionth of a gram -- and 14 to 24 hours to obtain a fingerprint from a prepared sample, especially for fragments larger than 10,000 base pairs.

The new Laboratory-developed flow cytometer determines the fingerprint of DNA fragments with 98 percent or better accuracy in less than seven minutes from a prepared sample, regardless of the length of the fragments. Less than two-trillionths of a gram of DNA is required to perform the analysis. Sample preparation in both methods takes the same amount of time -- several minutes for isolated small fragments or several hours for a whole bacterial genome digest. The big difference is the time it takes to obtain a result. Flow cytometry can deliver results in one clinical shift, which will be especially valuable to hospital workers, compared with 24 hours for gel electrophoresis. Once the DNA is purified from the bacterial cells, researchers introduce an enzyme into the sample that chops up the pathogen's DNA into a defined set of fragments. The fragments then are stained with a fluorescent dye, the amount of which is directly proportional to the fragments' size. The larger the fragment, the more dye is bound to it.

The stained fragments are passed through the flow cytometer. As the laser strikes the fluorescent dye molecules that are bound to the fragment, a photon "burst" occurs. Because the number of photons in each burst is directly proportional to the fragment's size, the cytometer counts the photons in a burst to obtain an accurate fragment size measurement.

The resulting distribution of fragment sizes in the sample is its DNA fingerprint. The researchers then simply compare the fingerprint to those from a Los Alamos-developed database to identify the pathogen. "The new flow cytometer also has the potential to identify specific strains of bacterial species," noted Jett. This is crucial in epidemic tracing and for forensics, as well as for responding to a bio-agent attack where being able to identify the specific strain of an organism aids in tracing its origin. An earlier version of the flow cytometer received a 1997 R&D 100 Award from the Illinois-based R&D Magazine as one of the 100 most significant products, materials or processes with commercial promise for that year. Researchers are developing a smaller, portable version of the tool and are seeking an industrial partner to manufacture it. A patent has been granted.

Other LANL researchers who contributed to this work are: Pat Ambrose, Stefan Burde, Hong Cai, Julie Rusak, Peter Goodwin, Kevin Grace, Robb Habbersett, Erica Larson, Cheryl Lemanski, John Martin, Nileena Velappan, and Xiaomei Yan

Ternel N. Martinez, Public Affairs; photo by Leroy Sanchez

B Serious!



Contributed by Stefan Burde

B Scenes

Photos by Sandra Zink





"Let both men and women have babies"

B Scene

A bi-weekly desktop publication of Bioscience Division Los Alamos National Laboratory

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March is National Women's History Month. As part of LANL's celebration, the Women's Diversity Working Group sponsored a poster contest for students in Los Alamos, Espanola, Pojoaque and Santa Fe schools. The theme for this year's contest was "An Extraordinary Century for Women- Now, Imagine the Future". Some of the winning posters are on display in the Santa Clara Gallery on the second floor of the J. Robert Oppenheimer Study Center through March 31. A sampling of the entries are shown on this page.

For more information on the Women's Diversity Working Group, contact their web site at: http://www.lanl.gov/orgs/dvo/wdwg/women.html



"Let Women Vote, Let Women Play Sports, Let Women Teach Math"

